



Virginia Department of Health

Bureau of Toxic Substances

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FACT SHEET ON ETHYLENE DIBROMIDE

GENERAL INFORMATION

Ethylene dibromide (EDB) is a colorless, heavy, non-flammable liquid at room temperature with a sweet odor detectable in air at levels ranging from 10-25 parts per million (ppm). It is slightly soluble in water and miscible with most organic solvents.

USES

EDB was principally used as a scavenger in leaded gasoline, either alone or in combination with ethylene dichloride, to prevent the buildup of lead oxides from tetraethyl lead in automobile engines. It was also used as a pre-plant soil fumigant for the control of nematodes (rootworms) in tobacco, peanuts, soybeans, cotton, fruits and vegetables; as a post-harvest fumigant for citrus and tropical fruits to prevent the spread of fruit flies and other pests; as an intermediate in the synthesis of dyes and drugs; and as a solvent for resins, gums, and waxes. Some EDB was used in the fumigation of stored grain and grain milling machinery to prevent insect infestation. EDB is no longer used as a pesticide in the United States.

HEALTH EFFECTS

Inhalation is the most common source of occupational exposure to EDB. EDB may also be absorbed through the skin after direct contact with either the liquid or vapor. It is also readily absorbed from the gastrointestinal tract after being ingested. EDB is metabolized by liver enzymes and excreted in the feces and/or urine.

Acute Effects

Acute or short-term exposure to EDB may cause irritation of the eyes, nose, throat, and skin. In addition, overexposure may cause damage to the lungs, liver, kidneys, pancreas, spleen, heart, adrenal glands and testes. Inhalation exposure in humans has been associated with headache, decreased appetite, inability to sleep, nausea, and dizziness. Dermal contact may result in burning pain, as well as swelling, and blistering of the skin. Repeated contact may cause skin sensitization. Deaths have occurred following the inadvertent ingestion and inhalation of EDB. Accidental ingestion of 4.5 milliliter (ml) of EDB by a human caused vomiting, diarrhea, abdominal pain, renal failure and death within 54 hours. The available data from case history reports indicate that EDB may be lethal to humans after a single oral dose of 65 milligram per kilogram (mg/kg).

Chronic Effects

Chronic low level exposure of humans to EDB by inhalation may cause injury to the lungs, nervous system, liver, heart, and kidneys.

Carcinogenicity

EDB has been shown to cause cancer in rats and mice by all routes of exposure (oral, inhalation, and dermal). It produces tumors at the site of direct contact and at sites remote from the site of administration. Tumors produced at the site of contact included:

- Oral doses of 20 and 40 mg/kg/day produced squamous cell carcinomas of the forestomach in animals of both species.
- Inhalation doses of 10 and 40 ppm for 6 hours per day produced nasal cavity tumors in both species.
- Doses of 25 mg/mouse/day applied to the skin of mice produced skin papillomas and carcinomas.

Tumors produced at tissues remote from the site of contact in each bioassay included:

- hemangiosarcomas of the circulatory system in mice in the oral gavage study;
- hemangiosarcomas of the circulatory system in rats in the inhalation studies and alveolar/bronchiolar carcinomas in mice in the inhalation studies; and,
- respiratory tract (lung) tumors in mice in the skin painting study.

The tissues remote from the site of direct contact in which tumors were produced would have had relatively low exposure to EDB. They presumably responded because of unique toxicokinetic, metabolic or other biochemical characteristics. These sites are therefore of concern with chronic low level exposures. These animal data indicate that EDB is a potential human carcinogen. A human epidemiologic study of cancer mortality provides suggestive evidence of excess cancer risk in workers exposed to EDB. However, this study is inconclusive because of methodological weaknesses.

Studies in animals dosed with disulfiram (Antabuse) and EDB clearly indicate a synergistic carcinogenic effect. Therefore, workers taking disulfiram may be at increased risk of developing cancer. The Environmental Protection Agency (EPA) has classified EDB as a probable human carcinogen (cancer causing agent) in Group B₂ meaning there is sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans.

Reproductive Effects

EDB has been shown to produce adverse reproductive effects in several species of animals. These adverse effects include reduced sperm production, reduced sperm motility, abnormal sperm structure, reduced egg weight, reduced egg production, reduced fertility, reduced fetal implants and fetal weight, sterility, as well as malformation and skeletal anomalies in offspring. Doses as low as 10 ppm produced reproductive toxicity in animals. These animal data suggest that EDB may potentially affect human reproductive capacity and the offspring of male and female EDB workers. However, available human epidemiological studies provide inconclusive evidence that EDB may affect fertility in male workers exposed to EDB due to methodological problems with the studies.

Mutagenic Effects

EDB is a potent mutagen (causes genetic damage), producing point (gene) mutation, chromosomal aberration and primary DNA damage in both *in vivo* and *in vitro* systems. It was mutagenic to bacteria, fungi, vascular plants, insects and cultured mammalian cells in the absence of an exogenous metabolic activation system. It induced chromosomal aberrations and sister chromatid exchanges in cultured mammalian cells.

STANDARDS AND GUIDELINES

EPA has set a Maximum Contaminant Level (MCL) at 0.05 microgram/liter ($\mu\text{g/l}$). This is the lowest level to which water systems can reasonably be required to remove this contaminant should it occur in drinking water. The ten-day health advisory is 8.0 $\mu\text{g/l}$. Health advisory provides the level of a contaminant in drinking water at which adverse health effects would not be anticipated. The current Occupational Safety and Health Administration (OSHA) standard for EDB in workplace air is 20 ppm as an 8-hour time-weighted average (TWA), with an acceptable ceiling level of 30 ppm (averaged over a 15 minute period) and a maximum peak concentration of 50 ppm for 5 minutes during an 8-hour work shift.

ENVIRONMENTAL EFFECTS

EDB enters the environment when it is released during the use, storage, and transport of leaded gasoline, as well as during any spills. It can also enter the environment from its former use as a pesticide, as well as wastewater and emissions from processes of the chemical industries that use it. When spilled on land or applied to land during soil fumigation, EDB may leach to groundwater. EDB releases to water will mainly evaporate. It is readily degraded in the environment. Its half-life (50% degradation) is: 19-120 days in groundwater; 1 month to 19 years in soil; and 10-107 days in air. It does not tend to accumulate in aquatic life.

SYNONYMS: 1,2-dibromoethane; ethylene bromide; sym-dibromoethane; and glycol bromide.

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